SAMPLE QUESTION PAPER

BLUE PRINT

Time : 2 Hours

Max. Marks : 35

S. No.		Chapter	Section-A (2 marks)	Section-B (3 marks)	Section-C (5 marks)	Total
8.	Unit-V	Electromagnetic Waves	–	1(3)	–	6(17)
9.	Unit-VI	Ray Optics and Optical Instruments	1(2)#	3(9)	–	
10.		Wave Optics	–	1(3)#	–	
11.	Unit-VII	Dual Nature of Radiation and Matter	–	–	1(5)	3(11)
12.	Unit-VIII	Atoms	–	1(3)*	–	
13.		Nuclei	–	1(3)	–	
14.	Unit-IX	Semiconductor Electronics : Materials, Devices and Simple Circuits	2(4)	1(3)	–	3(7)
		Total Questions	**3(6)**	**8(24)**	**1(5)**	**12(35)**

*It is a choice based questions.

#Out of the two or more questions only one question is choice based.

General Instructions :

(i) *There are 12 questions in all. All questions are compulsory.*
(ii) *This question paper has three sections: Section A, Section B and Section C.*
(iii) *Section A contains three questions of two marks each, Section B contains eight questions of three marks each, Section C contains one case study-based question of five marks.*
(iv) *There is no overall choice. However, an internal choice has been provided in one question of two marks and two questions of three marks. You have to attempt only one of the choices in such questions.*
(v) *You may use log tables if necessary but use of calculator is not allowed.*

SECTION - A

1. If the rms value of sinusoidal input to a full wave rectifier is $\frac{V_0}{\sqrt{2}}$ then find the rms value of the rectifier's output.

2. The focal length of an equiconcave lens is 3/4 times of radius of curvature of its surfaces. Find the refractive index of the material of the lens. Under what condition will this lens behave as a converging lens?

OR

A fish in a water tank sees the outside world as if it (the fish) is at the vertex of a cone such that the circular base of the cone coincides with the surface of water. Given the depth of water, where fish is located, being 'h' and the critical angle for water-air interface being 'i_c', find out by drawing a suitable ray diagram the relationship between the radius of the cone and the height 'h'.

3. A pure semiconductor has equal electron and hole concentration of 10^{16} m^{-3}. Doping by indium increases n_h to 5×10^{22} m^{-3}. Then, find the value of n_e in the doped semiconductor.

SECTION - B

4. Draw a graph showing the variation of potential energy between a pair of nucleons as a function of their separation. Indicate the regions in which the nuclear force is (i) attractive, (ii) repulsive.

5. Define the term, "refractive index" of a medium. Verify Snell's law of refraction when a plane wavefront is propagating from a denser to a rarer medium.

6. A prism is made up of material of refractive index $\sqrt{2}$. The angle of the prism is A. If the angle of minimum deviation is equal to the angle of the prism, then find the value of A.

7. How does an oscillating charge produce electromagnetic wave? Explain.
Draw a sketch showing the propagation of plane *e.m.* wave along the Z-direction, clearly depicting the directions of oscillating electric and magnetic field vectors.

8. The value of ground state energy of hydrogen atom is –13.6 eV.
   (i) Find the energy required to move an electron from the ground state to the first excited state of the atom.
   (ii) Determine (a) the kinetic energy and (b) orbital radius in the first excited state of the atom.
   (Given the value of Bohr radius = 0.53 Å).

OR

State Bohr's postulate to define stable orbits in hydrogen atom. How does de-Broglie's hypothesis explain the stability of these orbits?

9. Define the terms 'depletion layer' and 'barrier potential' for a *p-n* junction. How does (i) an increase in the doping concentration and (ii) biasing across the junction, affect the width of the depletion layer?

10. Monochromatic light of wavelength 589 nm is incident from air on a water surface. If μ for water is 1.33, find the wavelength, frequency and speed of the refracted light.

11. A monochromatic source of wavelength 600 nm was used in Young's double silt experiment to produce interference pattern. I_1 is the intensity of light at a point on the screen where the path difference is 150 nm. Find the intensity of light at a point where the path difference is 200 nm.

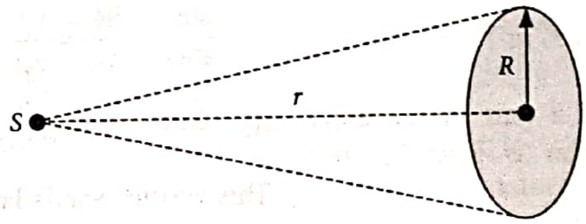
OR

A narrow slit of width 2 mm is illuminated by monochromatic light of wavelength 500 nm. What will be the distance between the first minima on either side on a screen at a distance of 1 m?

SECTION - C

12. CASE STUDY : EXPERIMENTAL STUDY OF PHOTOELECTRIC EFFECT

A point source S of power $P = 6{\cdot}4 \times 10^{-3}$W emits mono energetic photons each of energy 6·0 eV. The source is located at a distance of $r = 0{\cdot}8$ m from the centre of a stationary metallic sphere of work function 3·0 eV and of radius $1{\cdot}6 \times 10^{-3}$ m as shown in figure. The sphere is isolated and initially neutral and photoelectrons are instantly taken away from sphere after emission. The efficiency of photoelectric emission is one for very 10^5 incident photons.



(i) The power received by the sphere through radiations is
   (a) $\frac{4R^2}{Pr}$ (b) $\frac{PR^2}{4r^2}$ (c) $\frac{p^2R}{2\pi r}$ (d) $\frac{PR}{4r}$

(ii) Number of photons striking the metal sphere per second is
   (a) $6{\cdot}7 \times 10^9$ (b) $3{\cdot}3 \times 10^9$ (c) $6{\cdot}7 \times 10^{10}$ (d) $3{\cdot}3 \times 10^{10}$

(iii) The number of photoelectrons emitted per second is about
   (a) $3{\cdot}3 \times 10^4$ (b) $6{\cdot}7 \times 10^4$ (c) $6{\cdot}7 \times 10^{15}$ (d) $3{\cdot}3 \times 10^{15}$

(iv) The photoelectric emission stops when the sphere acquires a potential about
   (a) 2 V (b) 3 V (c) 4 V (d) 6 V

(v) If the distance of source becomes double from the centre of the metal sphere then the power received by the sphere
   (a) $\frac{PR^2}{4r^2}$ (b) $\frac{PR^2}{16r^2}$ (c) $\frac{PR^2}{4r}$ (d) $\frac{p^2R^2}{16r^2}$